U.S. Department of Transportation
**Federal Highway Administration**

**New York Division**

Leo W. O'Brien Federal Building, Suite 719
Clinton Avenue & North Pearl Street
Albany, NY 12207

March 20, 2009

Mr. Steve Zargham, Director
Design Quality Assurance Bureau, POD 23
New York State Department of Transportation
50 Wolf Road
Albany, New York 12232

In Reply Refer To:
HDO-NY

Subject: PIN X729.77, I-278 (BQE), Kosciuszko Bridge, Kings and Queens Counties

Dear Mr. Zargham:

In response to the request in your February 27, 2009 letter, attached is a signed copy of the Record of Decision (ROD) for the subject project. In addition to approving the ROD, we also grant design approval and approval of non-standard features for the subject project.

If you have any questions or comments, please feel free to contact Tom Breslin at (518) 431-4125, extension 257.

Sincerely,

Chris Gatchell
District Operations Engineer

Attachment

cc:
R. Adams, NYSDOT, Region 11 Office of Structures with attachment
R. Lessard, NYSDOT, Main Office, DQAB, POD 23 - with attachment
N. Tatevossian/H. Fink, NYSDOT, Region 11 Office of Structures
P. King, NYSDOT, Region 11, RPPM
M. Bergmann, NYSDOT, Region 11, R Quality Control Engineer
D. Munoz, NYSDOT, Main Office, Structures, POD 43

# Record of Decision
# U.S. Department of Transportation
# Federal Highway Administration

## PIN X729.77
## Kosciuszko Bridge (I-278) over Newtown Creek
## Kings and Queens Counties, New York
## FHWA-NY-EIS-07-01-F

This Record of Decision (ROD) considers the proposal by the New York State Department of Transportation (NYSDOT) to provide safety, operational, and structural improvements to the Kosciuszko Bridge over Newtown Creek. This project is in conformance with the surface transportation act signed into law by the President on August 10, 2005, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), and the National Environmental Policy Act of 1969 (NEPA).

The Kosciuszko Bridge, which is named after the Polish-born Revolutionary War hero Thaddeus Kosciuszko, carries a 1.1-mile segment of the Brooklyn-Queens Expressway (BQE, Interstate 278) between Morgan Avenue in the borough of Brooklyn (Kings County) and the Long Island Expressway (LIE, Interstate 495) interchange in the borough of Queens (Queens County). The bridge, which opened to traffic on August 24, 1939, is a vital link in the region's transportation network carrying BQE traffic over Newtown Creek, which forms the border between Brooklyn and Queens in this area. As one of New York City's few north-south interstates, the BQE serves commuter and local traffic, as well as a significant amount of commercial traffic that is prohibited from neighboring parkways.

The bridge, which is over 69 years old, no longer functions as initially intended. In its original configuration, it connected Meeker Avenue in Brooklyn, a 4-lane arterial, to Laurel Hill Boulevard in Queens, also a 4-lane arterial. With the construction of the BQE a decade later, the Kosciuszko Bridge became an integral part of the interstate highway system, and later was modified during the 1960's to carry six lanes of traffic (three lanes in each direction). Currently, over 160,000 vehicles use the bridge each day. The bridge's high traffic volumes, when combined with an existing vertical profile that is not in compliance with modern standards for an interstate highway, result in unacceptably high accident rates and excessive delays to traffic.

In addition, the deteriorating bridge has undergone a series of major roadway and structural repairs over the past two decades. However, despite these aggressive maintenance efforts, the structural deficiencies are increasing. The frequent repairs and their associated lane closures, while necessary to keep the bridge in a state of good repair, exacerbate the congestion and traffic diversion problems identified with the bridge and do not provide a long term solution to the structure's underlying problems.

Based on its review of the potential impacts of the proposed project, the Federal Highway Administration (FHWA) and the NYSDOT concluded that it was appropriate to prepare an Environmental Impact Statement (EIS) to identify and evaluate the transportation, social, economic, and environmental impacts of possible solutions. A Notice of Intent to prepare an EIS was published in the *Federal Register* on April 25, 2002. Formal NEPA scoping meetings were held in both Queens and Brooklyn on May 14, 2002 and May 21, 2002, respectively.

Since NEPA requires that all reasonable alternatives be considered in an EIS, the NYSDOT completed an Alternatives Analysis process designed to consider a wide-range of alternatives and to narrow that list down to a manageable number for detailed study in the EIS. An original "Long List" of alternatives was developed, consisting of the No Build (or no action) Alternative and 25 Build Alternatives in four general categories: rehabilitation in-kind, rehabilitation with widening, bridge replacement, and tunnel.

The Long List of alternatives was evaluated through a two-step screening process designed to select the alternatives most likely to meet the project's purpose and need. Each step in this iterative process was designed to focus increasingly detailed analysis on progressively fewer alternatives. At the end of the screening process, the No Build Alternative and five (5) Build Alternatives were advanced for detailed evaluation in the EIS.

The FHWA, in partnership with the NYSDOT, prepared a Design Report/Draft Environmental Impact Statement/Draft Section 4(f) Evaluation (DR/DEIS/Draft Section 4(f) Evaluation) to evaluate the reasonably foreseeable social, economic, environmental, and transportation impacts and benefits that would occur with the Build Alternatives considered compared to future conditions without the project. The DR/DEIS/Draft Section 4(f) Evaluation was published on March 23, 2007 and circulated for public and agency review. Public Hearings were held in both Brooklyn and Queens on April 19, 2007 and April 26, 2007, respectively.

The NYSDOT addressed all comments received on the DR/DEIS/Draft Section 4(f) Evaluation and conducted additional agency coordination to resolve remaining issues associated with the project. Following these actions, the FHWA determined that the requirements of NEPA were satisfied for the proposed project and signed the title sheet for the Final Design Report/Final Environmental Impact Statement/Final Section 4(f) Evaluation (FDR/FEIS/Final Section 4(f) Evaluation) on November 25, 2008. A Notice of Availability for the FDR/FEIS/Final Section 4(f) Evaluation was published in the *Federal Register* on December 19, 2008.

## A. DECISION

The action recommended by the NYSDOT and adopted by the FHWA is the replacement of the Kosciuszko Bridge, as defined by **Alternative BR-5** in the FDR/FEIS/Final Section 4(f) Evaluation. Alternative BR-5 replaces the existing bridge, building a new permanent, parallel bridge on the eastbound side of the existing bridge. This selected alternative provides superior safety, operational, and structural improvements compared with the other Build Alternatives, while minimizing adverse social, economic, and environmental impacts to the extent practicable. As defined by the project's goals and objectives, the selected alternative addresses the purpose and needs of the project by:

- Reducing the frequency and severity of traffic accidents in the corridor by eliminating non-standard elements on the bridge;
- Improving traffic operations in the corridor, reducing delays and increasing efficiency and reliability;
- Minimizing the diversion of highway traffic to local streets, both during construction and long-term; and
- Eliminating infrastructure deficiencies.

## B. ALTERNATIVES CONSIDERED

This section provides a brief description of the alternatives evaluated in the FDR/FEIS/Final Section 4(f) Evaluation, while explaining the balancing of values which formed the basis for the FHWA's decisions, including the identification and selection of the environmentally preferred alternative. The selected alternative, along with the other Build Alternatives considered, are fully described in the Preferred Alternative and Chapter III sections of the FDR/FEIS/Final Section 4(f) Evaluation.

No Build Alternative

The No Build Alternative would make no safety or operational improvements on the Kosciuszko Bridge, but would continue NYSDOT's ongoing maintenance program. The existing bridge, with its three eastbound and three westbound lanes, steep grades, narrow lane widths, and non-standard shoulders, would remain as it is today.

Alternative RA-5: Rehabilitation with New Parallel Bridge on Eastbound Side

Alternative RA-5 would rehabilitate the existing bridge and construct a new parallel bridge on the eastbound (Queens-bound) side. When completed, the new bridge would carry three lanes of eastbound traffic with standard lane widths and shoulders. The new bridge would be built at a lower elevation to allow for reduced grades. The existing bridge would be rehabilitated and continue to carry six lanes of traffic (two eastbound, four westbound), maintaining the existing narrow lane widths, non-standard (narrow) shoulders, and steep grades. The parallel bridge would be built first, so that six lanes of traffic could be maintained while the existing bridge is rehabilitated, half at a time.

Alternative RA-6: Rehabilitation with New Parallel Bridge on Westbound Side

Alternative RA-6 would rehabilitate the existing bridge and construct a new parallel bridge on the westbound (Brooklyn-bound) side. When completed, the new bridge would carry three lanes of westbound traffic with standard lane widths and shoulders. The new bridge would be built at a lower elevation to allow for reduced grades. The existing bridge would be rehabilitated and continue to carry six lanes of traffic (two westbound, four eastbound), maintaining the existing narrow lane widths, non-standard (narrow) shoulders, and steep grades. The parallel bridge would be built first, so that six lanes of traffic could be maintained while the existing bridge is rehabilitated, half at a time.

Alternative BR-2: Bridge Replacement with Permanent Eastbound Bridge and Temporary Westbound Bridge

Alternative BR-2 would replace the existing bridge by building new parallel bridges on both sides of the existing bridge – one temporary, one permanent. The existing bridge would then be demolished and new bridge structures built in its place. When completed, the new bridges would carry five lanes of eastbound traffic and four lanes of westbound traffic and have standard lane widths and shoulders. The new bridges would be built at a lower elevation to allow for reduced grades. Construction of the parallel bridges would allow six lanes of traffic to be maintained while the existing bridge is demolished and the alternative completed.

Alternative BR-3: Bridge Replacement with Permanent Bridges on both Eastbound and Westbound Sides

Alternative BR-3 would replace the existing bridge by building new parallel bridges on both sides of the existing bridge. The existing bridge would then be demolished and new bridge structures built in its place. When completed, the new bridges would carry five lanes of eastbound traffic and four lanes of westbound traffic and have standard lane widths and shoulders. The new bridges would be built at a lower elevation to allow for reduced grades. Construction of the parallel bridges would allow six lanes of traffic to be maintained while the existing bridge is demolished and the alternative completed.

Alternative BR-5: Bridge Replacement with Permanent Bridge on Eastbound Side

Alternative BR-5 would replace the existing bridge by building two new parallel bridges on the eastbound (Queens-bound) side of the existing bridge. The existing bridge would then be demolished and a new bridge structure built in its place. When completed, the new bridges would carry five lanes of eastbound traffic and four lanes of westbound traffic and have standard lane widths and shoulders. The new bridges would be built at a lower elevation to allow for reduced grades. Construction of the parallel bridges would allow six lanes of traffic to be maintained while the existing bridge is demolished and the alternative completed.

The following sections provide an overall comparison of the Build Alternatives in order to guide the decision-making process. This process includes an evaluation of how well each Build Alternative addresses the purpose and needs of the project, providing a comparison of the alternatives against one another. It also includes a summary of the adverse impacts and benefits anticipated by each of the Build Alternatives. These anticipated impacts and benefits are described in detail in Chapters III and IV of the FDR/FEIS/Final Section 4(f) Evaluation.

Because of the constraints associated with implementing a project of this size in a dense urban area, the Build Alternatives have many similar features and impacts. Each of the Build Alternatives provides operational improvements to the Kosciuszko Bridge when compared to the No Build Alternative. None of the Build Alternatives results in significant social impacts. Each of the Build Alternatives has similar positive and negative impacts on the local economy. Positive impacts include jobs generated both directly and indirectly from the construction project and the productivity benefits that come with reduced congestion on the BQE. Negative economic impacts result from the relocation of businesses and jobs and the loss of property tax revenue resulting from right-of-way acquisition. Impacts to Newtown Creek are similar for each of these alternatives. Each of the Build Alternatives has identical impacts on air quality. Each impacts Sergeant William Dougherty Playground, but increases the quantity of parkland in the area. The following sections will attempt to highlight differences in features and impacts.

Grades

All new bridges associated with each of the Build Alternatives would be built at a lower elevation, decreasing the vertical clearance over Newtown Creek from 38 m (125'-0") to approximately 27 m (88'-6"), to improve traffic safety and operations on the bridge by decreasing the steep roadway grades from 4% to 2%. No changes would be made to the grades on the existing bridge, which are retained by Alternatives RA-5 and RA-6.

Shoulders

Because Alternatives RA-5 and RA-6 continue to carry six lanes of traffic on the existing bridge, no improvements can be made to those shoulders. However, the new parallel bridge in each of those alternatives would be built with shoulders that meet the project's design criteria. Alternatives BR-2, BR-3, and BR-5 would have standard shoulders on the new bridge.

Since reconstructing the Brooklyn Connector to provide standard shoulders would require significant right-of-way impacts to the residential properties adjacent to the roadway in Brooklyn, the Brooklyn Connector segment will be reconstructed largely in-kind, retaining its non-standard shoulders with each of the Build Alternatives.

Lane Widths

While the existing bridge has standard 3.66 m (12'-0") lane widths over most of the project limits, the lanes on the existing main span narrow to 3.30 m (10'-10") wide. Alternatives RA-5 and RA-6 would retain these narrow lane widths on the existing bridge. However, the new parallel bridge built in each of those alternatives, as well as all new bridges built for Alternatives BR-2, BR-3, and BR-5, would have standard lane widths throughout the project limits.

Auxiliary Lanes

Each of the Build Alternatives adds auxiliary lanes to the bridge, either through construction of a new bridge parallel to the existing one, or through the complete replacement of the bridge. Traffic studies conducted by the NYSDOT show that traffic operations would be most effectively improved through the addition of two eastbound auxiliary lanes and one westbound auxiliary lane. The studies further show that operations in the eastbound direction could be improved by physically separating LIE-bound traffic from BQE through traffic to reduce merging and weaving movements on the bridge. Four of the Build Alternatives achieve this preferred lane configuration.

Alternative RA-5 constructs a new parallel bridge on the eastbound side of the existing bridge, which would provide three travel lanes for LIE-bound traffic and vehicles entering the BQE from the Vandervoort Avenue entrance ramp. Two lanes on the existing bridge would remain eastbound and carry BQE through traffic. In Queens, the parallel bridge would reconnect with the existing bridge and provide a slip ramp for vehicles on that bridge (primarily those that entered on the entrance ramp) to continue on the BQE. The four remaining lanes on the existing bridge would be used for westbound traffic, providing an auxiliary lane connecting the entrance ramps from the LIE and 43rd Street to the Meeker Avenue/Morgan Avenue exit ramp in Brooklyn. This would provide a significantly longer distance over which vehicles can merge into or out of BQE through traffic.

Alternative RA-6 also constructs a new parallel bridge, but on the westbound side of the existing bridge. This design does not allow for the provision of the preferred lane configuration described above. Using five lanes on the existing bridge for eastbound traffic would leave only one lane on the existing bridge (in addition to the three lanes on the new parallel bridge) to carry westbound traffic, with little or no shoulder available. Such a design is undesirable for safety reasons; should a vehicle become disabled in this single lane, vehicles behind cannot pass. Therefore, Alternative RA-6 provides four eastbound and five westbound lanes, with the *westbound* lanes separated between the existing bridge and the new parallel bridge.

Alternatives BR-2, BR-3, and BR-5 completely replace the existing bridge with a new bridge and would provide the preferred lane configuration described above. Each of these alternatives would provide two eastbound auxiliary lanes and one westbound auxiliary lane with eastbound traffic physically separated, as it would be in Alternative RA-5. The primary difference, however, is that all lanes would be on new structures, providing other benefits described below.

Ramps and Merge Areas

All existing ramp connections to highways and the local street network would be maintained. Each of the Build Alternatives would add a second lane to the Vandervoort Avenue entrance ramp to the eastbound BQE, improving operations by allowing a greater volume of vehicles to efficiently enter the highway.

Average Speeds

By 2045 with the No Build Alternative, peak hour speeds across the bridge are expected to drop to 19 km/h and 28 km/h (12 mph and 17 mph) in the a.m. peak hour for eastbound and westbound traffic, respectively, with p.m. peak hour speeds dropping to 11 km/h (7 mph) in both directions. The Build Alternatives each make significant improvements to these projections. Alternative RA-5 would increase peak hour eastbound speeds to over 60 km/h (37 mph) and westbound speeds to approximately 40 km/h (25 mph). Alternative RA-6, with five westbound lanes, would have higher westbound speeds (approximately 50 km/h (31 mph) in the peak hours), but lower eastbound speeds (35 km/h [22 mph]) and 48 km/h (30 mph) in the a.m. and p.m. peak hours, respectively). Alternatives BR-2, BR-3, and BR-5 would make the greatest improvements to speed, with eastbound speeds of 68 km/h (42 mph) and 72 km/h (45 mph) in the a.m. and p.m. peak hours, respectively, and 47 km/h (29 mph) for the westbound direction in both peak hours.

Travel Delay

The travel speeds described above directly affect the amount of delay experienced by vehicles on the BQE. Because of their interrelatedness in terms of operations, delay for vehicles on Meeker Avenue was also considered in the analysis. By 2045, vehicles traveling on the BQE and Meeker Avenue within the study limits were projected to experience a total of 705 hours of delay during the a.m. peak hour and 816 hours of delay in the p.m. peak hour. Alternative RA-5 would reduce this significantly to 314 and 285 hours of delay in the a.m. and p.m. peak hours, respectively. Alternative RA-6 would make more modest improvements with 387 and 328 hours of delay in the peak hours. Finally, Alternatives BR-2, BR-3, and BR-5 would make the greatest improvements with delay reduced to 235 hours of delay in the a.m peak hour and 206 hours of delay in the p.m. peak hour.

Level of Service

Each of the Build Alternatives would improve level of service (LOS) within the project limits, particularly where LIE-bound traffic is physically separated from BQE through traffic. Alternatives RA-5, BR-2, BR-3, and BR-5 would provide the most improvement for eastbound traffic, while Alternative RA-6 would provide better service for westbound traffic. While many segments will continue to operate at LOS E or F, all will operate at improved levels compared to the No Build Alternative.

Safety

Each of the Build Alternatives would make improvements to the safety of vehicles using the BQE and Meeker Avenue in the study area. By improving operational conditions and reducing congestion, it is expected that many of the accidents that result from stop-and-go conditions would be reduced. Most significantly, the physical improvements proposed with each of the Build Alternatives, such as improved shoulders, lane widths, and sight distance, will reduce accidents in both congested and uncongested conditions. Further, by providing shoulders, the Build Alternatives will also reduce the impact of disabled vehicles (blocked travel lanes) on traffic operations. Alternatives RA-5 and RA-6 include these physical improvements only on their new parallel structures, while all travel lanes would benefit from these improvements with Alternatives BR-2, BR-3, and BR-5. Since Alternatives RA-5 and RA-6 retain the existing bridge, they would retain the existing narrow lane widths, non-standard (narrow) shoulders, and steep grades.

Construction Duration

Since Alternatives RA-5 and RA-6 would rehabilitate the existing bridge, and rehabilitation takes less time than new construction, construction of these alternatives could be completed more quickly (3 years, 9 months for either). Among Alternatives BR-2, BR-3, and BR-5, the primary difference in construction duration is the extent of temporary structures required and the complexity of construction staging. Alternative BR-2, which would build a temporary bridge the full length of the project limits and, once it is removed, build permanent structures in its place, would require the longest construction period (6 years) of the Build Alternatives. Alternatives BR-3 and BR-5, which are very similar in type and construction staging, would take five (5) years to construct.

Cost

Similar to construction duration, project cost is determined largely by the amount of new construction and the complexity of construction staging. Alternatives RA-5 and RA-6 require the least amount of new construction and are, therefore, the least expensive. The primary difference between the costs of these two alternatives is the lack of a bikeway/walkway on Alternative RA-6. Because of its temporary bridge and complex staging, Alternative BR-2 is the most expensive alternative. While Alternative BR-3 does not require the same extent of temporary structures, it too has relatively complex staging, requiring the westbound structure to be widened after demolition of the existing bridge. Alternative BR-5, with its relatively straightforward construction staging, is the least expensive of the Bridge Replacement Alternatives. With Alternatives RA-5 and RA-6, it is anticipated that even after this major rehabilitation, continued maintenance and repairs would be required over the life of the existing bridge, resulting in higher maintenance costs compared with the Bridge Replacement Alternatives.

Construction-Period Employment

Construction of any of the Build Alternatives will create on-site and off-site construction-period jobs. Besides the workers on-site, this includes those involved in the manufacture or assembly of materials before they reach the site and even food and beverage jobs serving the on-site workers. Because job creation is a direct function of the amount of expenditures, the number of jobs created by each alternative would parallel their respective construction costs. Alternatives RA-5 and RA-6 would create the fewest jobs and Alternative BR-2 would create the most.

Relocation of Businesses and Residences

Due to the dense urban setting of the project, with businesses operating immediately adjacent to and, in some cases, beneath the BQE, each of the Build Alternatives would require the relocation of a number of businesses. Alternatives RA-6 and BR-5 require the relocation of the fewest businesses, while Alternatives BR-2 and BR-3 require the highest number of relocations.

Each Build Alternative would temporarily or permanently impact a cluster of three houses located adjacent to the BQE in Queens, locating a temporary or permanent structure within close proximity. Alternatives RA-5 and RA-6 would require temporary easements on a portion of these properties, while Alternatives BR-2 and BR-3 would require permanent easements as well. Alternative BR-5 would require the relocation of all three residences.

Bikeway/Walkway

Alternatives RA-5, BR-2, BR-3, and BR-5 each construct a new bikeway/walkway on the bridge connecting to Meeker Avenue near Van Dam Street in Brooklyn and to the existing pedestrian walkway over Laurel Hill Boulevard in Queens. Due to physical constraints caused by the proximity of the new parallel bridge to Old Calvary Cemetery, Alternative RA-6 does not include a bikeway/walkway.

Parks and Recreation

Each of the Build Alternatives would have temporary and permanent impacts on Sergeant William Dougherty Playground in Brooklyn. The permanent impact involves the acquisition of parkland ranging from 297 $m^2$ (3,197 $ft^2$) under Alternative RA-6 to 1,299 $m^2$ (13,982 $ft^2$) under Alternative BR-5, and all include a partial loss of function. Each of the Build Alternatives would also impact a one-foot strip of property owned by the New York City Department of Parks and Recreation (NYCDPR). As mitigation for this impact and as part of NYSDOT's Environmental Initiative, which seeks to incorporate environmental betterments into their projects, each Build Alternative includes substantial improvements to both the quality and quantity of parkland in both Brooklyn and Queens. Each of the Build Alternatives would enlarge and reconstruct Sergeant William Dougherty Playground, expanding it into the adjacent property, which must be acquired by each Build Alternative. In addition, each Build Alternative would create new parkland on the north side of the BQE in Brooklyn near the Meeker Avenue/Morgan Avenue exit ramp and in Queens between 54$^{th}$ Avenue and 54$^{th}$ Drive. These new parks would include both passive and active recreation features and would increase total park space in the project area by between four and five times over existing park space, depending on the alternative.

Surface Waters

Each of the Build Alternatives will take advantage of the project's location on Newtown Creek, using it as the primary means for transporting materials and equipment to the project site during construction. While this will eliminate a significant number of construction truck trips that would otherwise occur on the local street network, it will require the construction of temporary platforms in the creek where barges carrying supplies to the site would dock. While existing water depths in Newtown Creek are sufficient to get barges to the site, some dredging would be required adjacent to the temporary platforms. This dredging would remove contaminated sediment present in the creek and, with the use of silt curtains and silt screens, will have minimal impact on water quality.

With each of the Build Alternatives, the existing deteriorated bulkheads would be replaced with riprap, creating a more natural shoreline and additional habitat and floodplain. The extent of this benefit would be increased with Alternatives BR-2, BR-3, and BR-5, which would each remove the existing pier towers that extend into the creek.

Noise

The Kosciuszko Bridge is located in a relatively noisy urban environment, with the BQE, LIE, and local streets all contributing to noise in adjacent communities. The project's noise study found that existing noise levels exceed the federal Noise Abatement Criteria and that in some areas noise levels would increase with the project. The majority of residences impacted by roadway noise are in Brooklyn where the BQE and Meeker Avenue are in close proximity to residences on Meeker Avenue and adjacent side streets. However, the noise study also found that in Brooklyn, the majority of noise at these residences comes from Meeker Avenue, not the BQE. Because it is not practical to construct noise walls on Meeker Avenue, no effective mitigation measures could be identified. Each of the Build Alternatives would marginally increase the number of residences projected to be above the Noise Abatement Criteria, except for Alternative BR-5, which would marginally reduce the number of impacted residences.

Air Quality

The project evaluated the potential for air quality impacts at both the microscale (intersection) and mesoscale (area-wide) levels, focusing on impacts from increased emissions of carbon monoxide and particulate matter (PM). The air quality study found that the project would have no impacts at the microscale level. The mesoscale analysis considered increased emissions resulting from changes in traffic volumes or travel patterns in 2015, 2025, and 2035. While no impacts would result from the project in either 2015 or 2025, each of the Build Alternatives would increase mesoscale emissions of fine particles ($PM_{2.5}$) by 2.52-2.75 percent over the No Build Alternative in 2035. These impacts do not affect the project's regional conformity status.

Contaminated Materials

Each of the Build Alternatives requires the excavation of soil for the construction of bridge foundations and the dredging of sediment in Newtown Creek for the construction of temporary platforms. With a long history of industrial activity in the area, much of the area to be excavated was found to be contaminated. Additionally, the location of a large underground oil plume in Brooklyn creates the opportunity for further impacts during construction. For a more detailed discussion of the Brooklyn oil spill, refer to Section IV.B.3.i of the FDR/FEIS/Final Section 4(f) Evaluation. Each of the Build Alternatives is expected to encounter contaminated materials that must be handled and disposed of properly.

Cultural Resources

Each of the Build Alternatives would have an impact on one or both of the two properties in the project's study area determined to be eligible for inclusion in the National Register of Historic Places (NRHP), Old Calvary Cemetery and the Kosciuszko Bridge. Each of the Build Alternatives has similar potential for visual, auditory, or vibration impacts to Old Calvary Cemetery. Alternatives BR-2, BR-3, and BR-5 would each remove the NRHP-eligible Kosciuszko Bridge. Alternatives RA-5 and RA-6 would retain the existing bridge. Since both properties qualify as Section 4(f) resources, a Section 4(f) Evaluation is required. For a detailed summary of the results of the Final Section 4(f) Evaluation, see Section C of this ROD.

Based on the analyses included in the FDR/FEIS/Final Section 4(f) Evaluation, any of the Bridge Replacement Alternatives provide superior safety, operational, and structural improvements over the Rehabilitation Alternatives while having many of the same environmental impacts. Alternative BR-5 stands out as the environmentally preferred alternative. In Brooklyn, Alternative BR-5 shifts the alignment of the highway to the south, moving it further away from residences on Meeker Avenue between Van Dam Street and Hausman Street, providing noise reduction and visual benefits to these residences. This alignment shift also results in Alternative BR-5 having the lowest potential for impacts to the underground oil spill in Brooklyn. Alternative BR-5 also provides the greatest opportunity for new and improved parkland. With the exception of one of the Rehabilitation Alternatives, Alternative BR-5 has the least impact on nearby businesses and employees.

## C. SECTION 4(f)

A Section 4(f) Evaluation is prepared when a federally funded or approved transportation project proposes using land from a publicly owned park, recreation area, wildlife or waterfowl refuge, or historic site of National, State, or local significance. Under Section 4(f) of the Department of Transportation Act of 1966 (49 USC 303), the FHWA cannot approve the use of any Section 4(f) resource for transportation purposes unless it determines that there is no prudent and feasible alternative to using the resource, and that the action includes all possible planning to minimize harm to the protected property.

A Section 4(f) Evaluation is required for the proposed project because the selected alternative requires demolition of the existing NRHP-eligible Kosciuszko Bridge and includes permanent impacts to Sergeant William Dougherty Playground, a mapped public park located near the bridge in Brooklyn. Effects of the project alternatives on Old Calvary Cemetery, an NRHP-eligible resource located near the bridge in Queens, and potential archaeological resources are also given consideration in the Section 4(f) Evaluation.

### Avoidance Alternatives

In accordance with FHWA regulations and guidelines, the Section 4(f) Evaluation includes a discussion of "avoidance alternatives" that would avoid the use of Section 4(f) resources, and would therefore have no effect on those resources. The "avoidance alternatives" considered either did not meet the project's purpose and need, or had unacceptable adverse community impacts, which resulted when attempting to avoid adverse effects on Section 4(f) resources. As a result, none of these "avoidance alternatives" were determined to be prudent and feasible. A brief description of these alternatives is provided below:

- No Build - Under the No Build Alternative, only routine maintenance and repairs would be performed, resulting in no effect on the NRHP-eligible Kosciuszko Bridge and other Section 4(f) resources. However, the No Build Alternative would not meet the project's purpose and need;

- Rehabilitation In-Kind – The alternatives that rehabilitate the existing bridge in-kind, eliminating the need for constant repairs by addressing the bridge's structural deficiencies, would result in no effect on the NRHP-eligible Kosciuszko Bridge and other Section 4(f) resources. However, these alternatives make no safety or operational improvements. As a result, these alternatives would not meet the project's purpose and need;

- Rehabilitation with Widening - The rehabilitation alternatives that widen the existing bridge, adding a single lane on the bridge between the ramps in Brooklyn and Queens, would result in no effect on the NRHP-eligible Kosciuszko Bridge and other Section 4(f) resources. These alternatives would rehabilitate the existing bridge, eliminating the need for constant repairs by addressing the bridge's structural deficiencies. However, the additional lane provides minimal safety and operational improvements and does little to reduce the number of vehicles diverting from the highway to local streets. In addition, these alternatives would not address the primary safety deficiency found on the existing bridge by retaining the non-standard vertical profile, which does not comply with modern standards for an interstate highway. As a result, these alternatives would not meet the project's purpose and need;

- Rehabilitation with New Parallel Bridge - The rehabilitation alternatives that construct a new parallel structure on one side of the existing bridge would result in no effect on the NRHP-eligible Kosciuszko Bridge and Old Calvary Cemetery, but would encroach on Sergeant William Dougherty Playground, resulting in an adverse effect on this Section 4(f) resource. These alternatives would rehabilitate the existing bridge, eliminating the need for constant repairs by addressing the bridge's structural deficiencies. The new parallel structure would be built at a lower elevation and carry three lanes of traffic with standard lane widths and shoulders, providing some safety and operational improvements on the facility. However, these alternatives would not address the primary safety deficiency found on the existing bridge by retaining the non-standard vertical profile, which does not comply with modern standards for an interstate highway and results in an unacceptably high accident rate – as much as six and a half times the statewide average for similar facilities. As a result, these alternatives would not meet the project's purpose and need; and

- New Bridge or Tunnel on Westbound Side - To avoid impacting Sergeant William Dougherty Playground, several of the bridge replacement alternatives construct a new bridge or tunnel on the westbound (Brooklyn-bound) side of the existing bridge, the side opposite from the park. However, encroachment on Old Calvary Cemetery would result in an adverse effect on this NRHP-eligible resource, as well as significant adverse impacts on both residential and commercial properties (that otherwise would not occur) located on the westbound side of the existing bridge in Brooklyn. For these reasons, none of these alternatives were determined to be prudent and feasible.

Net Harm Analysis

Each of the Bridge Replacement Alternatives evaluated in the FDR/FEIS/Final Section 4(f) Evaluation meet the project's purpose and need. By providing superior safety, operational, and structural improvements over the Rehabilitation Alternatives, which fail to meet the project's purpose and need, Alternatives BR-2, BR-3, and BR-5 address the bridge's safety and operational deficiencies by providing standard lane widths, standard shoulders, and standard roadway grades across the entire facility. They also provide the most substantial improvements to traffic operations. Because they consist of entirely new bridges that take advantage of modern engineering technology and construction techniques, the design life and future maintenance needs of the Bridge Replacement Alternatives are superior to alternatives that would rehabilitate the existing 69-year-old bridge.

As outlined in FHWA guidance, if there is no feasible and prudent avoidance alternative to using Section 4(f) property/resources, an analysis to determine which alternative results in the least overall harm to the Section 4(f) resources must be performed.

Alternatives BR-2, BR-3, and BR-5 demolish the existing Kosciuszko Bridge, resulting in a total loss of the NRHP-eligible resource, create temporary audio intrusions during construction to the NRHP-eligible Old Calvary Cemetery, and potentially disturb NRHP-eligible archaeological sites that may warrant preservation in place. Each of these alternatives impacts Sergeant William Dougherty Playground, and provides reconstructed and new additional parkland as mitigation. The impacts to the Kosciuszko Bridge, Old Calvary Cemetery, and potential archaeological sites that might be present are identical for each of these alternatives and, therefore, are not discriminators in the net harm analysis. Each of these alternatives results in substantial increases in both the quantity and quality of parkland in the area. The proposed mitigation, measured in area of reconstructed and proposed new parkland, is very similar for these alternatives, with less than a three percent difference between alternatives.

Given the minimal differences between the net harm to Section 4(f) resources of Alternatives BR-2, BR-3, and BR-5, they are effectively equal in terms of harm to these resources, and are all eligible for selection as the environmentally preferred alternative. NYSDOT selected Alternative BR-5 as the environmentally preferred alternative based on the totality of the analyses described in the FDR/FEIS/Final Section 4(f) Evaluation.

Mitigation Measures

As the existing Kosciuszko Bridge will be demolished, the project adversely effects this Section 4(f) resource under Section 106 of the National Historic Preservation Act ("Section 106"). Pursuant to Section 106, mitigation measures to address this impact have been developed in consultation with the New York State Historic Preservation Office (NYSHPO), and are included in a Memorandum of Agreement (MOA) executed by NYSHPO, NYSDOT and FHWA.

As stipulated in the MOA, mitigation measures include photographic and historic documentation of the bridge according to Historic American Engineering Record (HAER) standards. NYSDOT is also committed to the installation of a permanent static display along the proposed bikeway/walkway on the new bridge that includes information on the Kosciuszko Bridge, its history and significance, and biographical information on Thaddeus Kosciuszko. The MOA also addresses potential vibration impacts to elements of Old Calvary Cemetery and potential impacts to any archaeological resources that might be present.

## D. MEASURES TO MINIMIZE HARM

As summarized below, and described in more detail in Chapter IV of the FDR/FEIS/Final Section 4(f) Evaluation, Alternative BR-5 incorporates numerous measures to mitigate unavoidable adverse impacts and minimize environmental harm, including but not limited to right-of-way, surface waters, cultural resources, air quality, noise, and contaminated materials.

### Right-of-Way

- Displaced property owners and tenants will be compensated by NYSDOT for the fair market value of their property.

- Relocation assistance and benefits will be made available to all individuals displaced by the project in accordance with New York State law, FHWA policy and regulations, and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended.

### Surface Waters

- The existing pier towers of the main span, which are located partially within Newtown Creek, will be removed, creating additional habitat and floodwater storage.

- Riprap will replace the existing deteriorated bulkheads in the immediate area of the bridge, providing conservation benefit to the area because it would increase the quality of the habitat. Riprap would soften the shoreline, reduce wave energy, and create additional beneficial fish habitat.

### Ecology

- NYSDOT will incorporate measures to control invasive species during construction operations, and could include the inspection and cleaning of construction equipment, commitments to ensure the use of invasive-free mulches, topsoil and seed mixes, and the development of control or eradication strategies should an invasion occur.

### Cultural Resources

- Since the existing Kosciuszko Bridge will be demolished under Alternative BR-5, the project will adversely effect this Section 4(f) resource. Mitigation measures to address this impact have been developed in consultation with the NYSHPO, and are included in the Section 106 MOA executed by NYSHPO, NYSDOT and FHWA. As stipulated in the MOA, mitigation measures will include photographic and historic documentation of the bridge according to Historic American Engineering Record (HAER) standards at a level to be determined by NYSDOT in consultation with NYSHPO.

- NYSDOT will install a permanent static display along the bikeway/walkway on the new bridge to include information on the Kosciuszko Bridge, its history and significance, and biographical information on Thaddeus Kosciuszko.

- NYSDOT, in consultation with the NYSHPO, will conduct archaeological testing prior to construction to identify any intact archaeological resources that may be disturbed during construction. If NRHP-eligible resources are found, NYSDOT will prepare and implement a data recovery plan in coordination with the NYSHPO.

- NYSDOT, in consultation with the NYSHPO, will develop a Construction Protection Plan (CPP) to protect contributing elements of Old Calvary Cemetery from vibration impacts. The CPP will set forth measures for protection and avoidance of structural and architectural damage from construction activities, monitoring of construction activities, and repair in the event of any damage.

### Visual/Design

- During the final design phase, NYSDOT will seek opportunities to incorporate design details into the new bridge to provide aesthetic benefits to the community.

- NYSDOT, in consultation with the community, will consider a wide range of "signature bridge" designs for the new main span of the bridge.

**Air Quality**

- NYSDOT will develop and implement a Community Air Monitoring Plan (CAMP) that establishes procedures for continuous upwind and downwind monitoring of air quality for airborne particulates and VOC vapors.

- Dust control measures, including the use of dust covers and frequent watering of affected areas, will be used to minimize ambient concentrations of airborne particulate matter and prevent airborne migration of potentially contaminated material.

- In order to reduce emissions, diesel engine retrofitted equipment and ultra-low sulfur diesel fuel will be used, whenever possible. Other technology may include Diesel Oxidation Catalyst/Diesel Particulate Filters, engine upgrades, engine replacements, or combinations of these strategies.

**Noise**

- Nighttime construction in residential areas will be limited to the maximum extent possible.

- NYSDOT will investigate the feasibility of installing noise-absorbent panels on new closure walls.

- NYSDOT will work with the NYCDPR to investigate the feasibility of alternative noise mitigation measures for reconstructed and new parkland.

- NYSDOT will examine the use of possible noise abatement measures, including:

    - Construction equipment noise control (properly maintained equipment);
    - Noise tents, acoustic screens, and temporary noise barriers where warranted;
    - Implementation of a construction noise monitoring program;
    - Scheduling of noisier activities during periods least sensitive to receptors; and
    - Minimizing work in any given location for a prolonged period of time.

**Contaminated Materials**

- NYSDOT will develop a Health and Safety Plan (HASP) to identify potential hazards associated with construction activities and describe mitigation measures to protect workers and the general public from exposure to hazardous materials.

- NYSDOT will develop a Spill Contingency Plan that will identify best management practices to be implemented during construction to minimize the risk of groundwater contamination.

- Based on further sampling and testing of soil in areas of excavation, NYSDOT will develop a soil management plan to identify waste and soil handling and disposal procedures to be used during construction.

- NYSDOT will develop a groundwater management plan that will describe prescribed methods for collecting, storing, and disposal of contaminated groundwater and petroleum product generated during construction.

- Taking advantage of the project's location on Newtown Creek, equipment and materials will be barged to the site, requiring the construction of temporary platforms in the creek. While water depths in the creek are sufficient for barges to reach the site, some dredging will be required along the shoreline. Dredging will be performed using a closed-top clamshell bucket to prevent dredged water and material from leaking or becoming re-suspended by spilling out of the bucket during the dredging operation. Properly maintained, weighted silt curtains will be used to confine the dredged area until the material has an opportunity to settle.

**Parks/Streetscaping**

- NYSDOT will work with NYCDPR and the local community to design and develop new parkland in Brooklyn and Queens.

- NYSDOT will construct a bikeway/walkway on the westbound side of the new Kosciuszko Bridge and will coordinate with the New York City Department of Transportation (NYCDOT) to ensure that it is integrated into the New York City Bicycle Master Plan.

- NYSDOT will provide launches for small, non-motorized boats on each side of Newtown Creek near the Kosciuszko Bridge. Ownership and maintenance responsibility for these launches will be determined during final design.

- NYSDOT will coordinate with the NYCDOT and NYCDPR to provide improved streetscaping, including plantings, reconstructed sidewalks, and new street furniture (*e.g.*, street lights) along all streets to be reconstructed as part of the project.

- NYSDOT will improve the pedestrian environment through enhanced streetscaping (described above), improved crosswalks, a new pedestrian crossing under the BQE at Hausman Street, and better pedestrian sightlines as a result of recessing the closure walls on the Brooklyn Connector.

**Traffic Control**

- In order to limit the number of construction truck trips on local streets to the maximum extent possible, NYSDOT is committed to bringing materials and equipment to the site by barge via Newtown Creek.

- In order to minimize vehicular detours in the community, NYSDOT will maintain six lanes of traffic on the bridge throughout construction.

- NYSDOT will consider providing a 24-hour tow truck to quickly clear accidents on the highway during the construction period.

- NYSDOT will coordinate with NYCDOT and the New York City Police Department (NYPD) to evaluate the need for Traffic Enforcement Agents at key intersections during construction.

- NYSDOT will coordinate with the local community and all relevant local agencies (*e.g.*, NYCDOT, NYPD, New York City Department of Sanitation, New York City Fire Department, etc.) to provide prior community notification of any required street closings, suspension of alternate side street parking regulations, and other activities with potential local traffic impacts.

- In order to minimize impacts on local parking, NYSDOT will coordinate with the selected contractor to identify off-street parking areas for construction workers.

- NYSDOT will coordinate and consult with the NYCDOT to incorporate intersection improvements, typically in the form of re-striping or signal timing adjustments, at a number of intersections in the project area. Some of the intersection improvements proposed within the immediate area include:

    - Adding a third travel lane to the exit ramp at McGuinness Boulevard/Humboldt Street as it approaches the Meeker Avenue intersection;

    - Re-striping the westbound Meeker Avenue approaches to both Kingsland and Morgan Avenues to accommodate one exclusive left-turn and two through lanes;

    - Re-striping the northbound Vandervoort Avenue approach to Meeker Avenue, to accommodate one exclusive right-turn, one right-turn/through, and one through lane; and

    - Providing signal timing changes at various Meeker Avenue intersections, including Vandervoort Avenue, Morgan Avenue and Kingsland Avenue.

In addition to the commitments described above, the NYSDOT's standard construction contract provisions include many "best practice" requirements that are specifically included for the purpose of avoiding, minimizing, and mitigating adverse environmental impacts. They will be incorporated in the project's construction contracts per NYSDOT procedures.

## E. MONITORING OR ENFORCEMENT PROGRAM

The NYSDOT, in consultation with the FHWA, will ensure the enactment of the mitigation measures described above using quality assurance reviews built into Departmental design and construction oversight processes. Specifically, individuals responsible for preparing the construction plans and those overseeing and monitoring their work will be provided a copy of this ROD and the FDR/FEIS/Final Section 4(f) Evaluation to assure that required environmental avoidance and mitigation measures are included in the plans and specifications prepared for the project. The Project Engineers overseeing the construction of the project will also receive a copy of these documents and will be responsible for assuring that all commitments are met. The NYSDOT and FHWA will coordinate with permitting agencies, as well as cooperating agencies, to ensure that design, construction, and maintenance of mitigation measures are performed in accordance with all permit requirements and best management practices. Refer to Section IV.B.3.k of the FDR/FEIS/Final Section 4(f) Evaluation for a detailed list of anticipated permits, approvals, and coordination.

## F. COMMENTS ON FDR/FEIS/FINAL SECTION 4(F) EVALUATION

A broad range of comments was received during the 30-day review period on the FDR/FEIS/Final Section 4(f) Evaluation following its publication on December 19, 2008. Comments were received from members of the public, a consultant for Old Calvary Cemetery, and several agencies, including the NYCDOT Office of Construction Mitigation and Coordination, the NYCDOT Division of Traffic Planning, the NYCDPR, the New York State Department of Health (NYSDOH), and the U.S. Environmental Protection Agency (USEPA). A detailed list of all comments received on the FDR/FEIS/Final Section 4(f) Evaluation and the responses that were prepared for them can be found in Appendix A of this ROD.

A letter from one member of the community supported the proposed improvements on the bridge. Another suggested the NYSDOT avoid installing sewer gratings that cover the full width of the proposed bikeway/walkway due to safety concerns for bicyclists using the new feature.

Many of the comments received from the NYCDOT reinforced their comments on the DR/DEIS/Draft Section 4(f) Evaluation, including the need to complete additional traffic studies and analyses during the Final Design phase and the need for coordination to complete detailed design involving local street and intersection improvements. These additional studies include a traffic signal warrant analysis, updated 24/7 traffic counts, and LOS analyses at key locations within the project area. The Division of Traffic Planning also requested additional information concerning the number of workers and vehicles estimated to be present during construction.

The NYCDPR was pleased to see that the preferred alternative includes a bikeway/walkway, noting that they believe the NYSDOT must go through the proper alienation process for the parkland to be permanently impacted by the project. In addition, they recommended the NYSDOT work closely with the NYCDPR when developing designs for the proposed park spaces, particularly the proposed locations under the bridge in Queens, and when selecting the native species plantings along the areas of Newtown Creek to be stabilized with rip-rap.

The NYSDOH noted that the Kosciuszko Bridge Project will involve construction and staging activities on several New York State Department of Environmental Conservation hazardous waste sites that involve public health oversight by the NYSDOH's Bureau of Environmental Exposure Investigation. They suggested that it will be important to consider information contained in the specific Site Management Plan documents that are implemented at specific intervals during the remedial process for each of these hazardous waste sites. The comments also raised important points to be identified and clarified in the proposed Community Air Monitoring Plan, as well as the need to ensure proper testing procedures are in place when constructing new public parks to avoid creating contaminant exposure pathways to the public.

The USEPA noted that its comments regarding air quality and the air impact analyses were adequately addressed in the FDR/FEIS/Final Section 4(f) Evaluation, such that the USEPA issued a "Lacks Objection" rating for the project. They encouraged the use of Environmental Performance Commitments for the utilization of materials, energy, emissions, and waste.

Comments from the Consulting Engineer for Old Calvary Cemetery expressed their concern that any pile driving activities could create vibration impacts to several old and large mausoleums in the cemetery. In addition, they expressed concern for drainage impacts to the cemetery due to storm water runoff from the new bridge. The comments also include a request for more detailed information of the temporary westbound bridge over Laurel Hill Boulevard.

## G. CONCLUSION

Based on the evaluation of social, economic, and environmental impacts contained in the FDR/FEIS/Final Section 4(f) Evaluation, the environmental mitigation measures proposed, and the written and oral comments offered by the public and public agencies, the FHWA has determined that in accordance with 23 CFR 771.105:

- The project, to the fullest extent possible, incorporates all environmental investigations, reviews, and consultations in a single coordinated process and complies with all applicable environmental requirements, as reflected in the environmental document required under NEPA;
- Alternative courses of action were evaluated and decisions were made in the best overall public interest based upon a balanced consideration of the need for safe and efficient transportation; the social, economic, and environmental impacts of the project; and national, state, and local environmental protection goals;
- Public involvement and a systematic interdisciplinary approach were essential parts of the development process for the project; and
- Measures needed to mitigate adverse impacts are incorporated into the project.

Based on the information provided in the FDR/FEIS/Final Section 4(f) Evaluation; consultation with appropriate federal, state, and local agencies and the general public; and review of comments received on the FDR/FEIS/Final Section 4(f) Evaluation, the FHWA adopts **Alternative BR-5** as the proposed action for this project. With authorization of design approval, the NYSDOT may proceed with final design of Alternative BR-5, including measures to mitigate adverse impacts, as described in the FDR/FEIS/Final Section 4(f) Evaluation and this ROD.

## H. STATUTE OF LIMITATIONS REGARDING DECISION

A Federal agency may publish a notice in the *Federal Register*, pursuant to 23 USC §139(1), indicating that one or more Federal agencies have taken final action on permits, licenses, or approvals for a transportation project. If such notice is published, claims seeking judicial review of those Federal agency actions will be barred unless such claims are filed within 180 days after the date of publication of the notice, or within such shorter time period as is specified in the Federal laws pursuant to which judicial review of the Federal agency action is allowed. If no notice is published, then the periods of time that otherwise are provided by the Federal laws governing such claims will apply. It should be noted that the FHWA-NY Division intends to pursue this provision by publishing a notice in the *Federal Register.*

Jeffrey W. Kolb

3/9/09

Jeffrey W. Kolb, P.E.
Division Administrator
New York Division Office
Federal Highway Administration

Date of Approval

# Record of Decision
# U.S. Department of Transportation
# Federal Highway Administration

## APPENDIX A

## SUMMARY OF COMMENTS RECEIVED ON THE FINAL DESIGN REPORT/ FINAL ENVIRONMENTAL IMPACT STATEMENT/ FINAL SECTION 4(F) EVALUATION

## PIN X729.77
## Kosciuszko Bridge (I-278) over Newtown Creek
## Kings and Queens Counties, New York
## FHWA-NY-EIS-07-01-F

The Federal Highway Administration (FHWA) and the New York State Department of Transportation (NYSDOT) received a variety of comments on the Final Design Report/Final Environmental Impact Statement/Final Section 4(f) Evaluation (FDR/FEIS/Final Section 4(f) Evaluation) during the review period following its publication on December 19, 2008. The following is a summary of the comments received and the responses prepared for them.

**Joanne Blair, local resident, handwritten letter to Tom Breslin, FHWA, December 20, 2008**

1. Comment: Please do improvements to the Kosciuszko Bridge [addressing] problems identified with the bridge - traffic congestion, traffic safety and structural conditions.

   Response: Comment noted.

**Harvey Botzman, Cyclotour Guide Book, handwritten note to Norik Tatevossian, NYSDOT, Undated**

2. Comment: My only comment is to make certain the new bridge and its approaches do not have sewer gratings covering the full width of the bikeway/pedestrian walkway. Bicyclists will avoid this grating and go into the motor vehicle lane.

   Response: The NYSDOT intends to design the new bikeway/walkway to be as safe and useable as practicable, meeting all modern design standards. Design details will be developed during the Final Design phase of the project. It should be noted that bicyclists and pedestrians will be separated from the roadway by a physical barrier to avoid the possibility of bicyclists entering the travel lanes.

**Moishe Strum, New York City Department of Transportation (NYCDOT), Office of Construction Mitigation and Coordination (OCMC) – Highways, e-mail to Robert Adams, NYSDOT, January 20, 2009**

3. Comment: I have examined your responses to my June 12, 2007 DEIS comments, which referenced a March 10, 2005 OCMC letter. Your responses discuss further traffic studies. Please indicate these studies may include LOS analysis and 24/7 traffic counts, if warranted.

Response: The NYSDOT, in consultation with the NYCDOT, will conduct further traffic studies (if warranted) during the Final Design phase, including updated 24/7 traffic counts and LOS analyses at key locations within the project's traffic study area.

4. Comment: The March 10, 2005 OCMC letter also transmitted a February 24, 2005 letter from the Fire Department. We would like to see your response to their comments.

   Response: Two of the four comments provided by the New York City Fire Department (FDNY) in their February 24, 2005 letter were addressed in Chapter VI of the FDR/FEIS/Final Section 4(f) Evaluation. These comments include FDNY's recommendations to avoid the creation of dead end roads and to maintain access to properties and buildings throughout the project limits. Refer to the responses for Comments ES-2 and ES-3 in Chapter VI of the FDR/FEIS/Final Section 4(f) Evaluation for more details.

   The two remaining comments concern upgrading existing water mains and hydrants throughout the project area and maintaining accessibility to hydrants and Siamese connections on buildings during construction. The NYSDOT will coordinate with the NYCDOT, FDNY, and the New York City Department of Environmental Protection (NYCDEP) during the Final Design and construction phases to provide opportunities to update water mains and hydrants. The NYSDOT will allow full accessibility to hydrants and connections on streets and to properties where it has the ability to do so.

   With regard to the installation of a standpipe system on the bridge, the NYSDOT will consult with FDNY during the Final Design phase. Nevertheless, the NYSDOT fully intends to ensure its structures meet the needs of emergency services personnel, including an adequate water supply for large-scale incidents on the bridge.

5. Comment: In [Drawing] PA-13, please state that intersection improvements will be made in consultation with NYCDOT Highway Design, Borough Traffic Engineer and Signals Divisions. A commitment should be stated regarding street lighting. The lighting improvements should be designed in consultation with NYCDOT Street Lighting.

   Response: The NYSDOT's commitment to coordinate and consult with the appropriate divisions of the NYCDOT during the final design of intersection improvements and new street lighting is included in Section D of the Record of Decision (ROD), particularly in the sections describing "Parks/Streetscaping" and "Traffic Control" measures.

6. Comment: [Drawing] PA-17: In the last paragraph, add NYCDOT to the list of agencies in parenthesis.

   Response: The NYSDOT's commitment to coordinate and consult with the NYCDOT, as well as all relevant local agencies, concerning potential local traffic impacts (e.g., required street closings and suspension of alternate side street parking regulations), is included in Section D of the ROD, particularly in the section describing "Traffic Control" measures.

7. Comment: [Drawing] III-89: It should state ".....to minimize and mitigate the impacts..."

   Response: While no subsequent document to the FDR/FEIS/Final Section 4(f) Evaluation is planned, the NYSDOT fully intends to coordinate with the NYCDOT to minimize and mitigate the impacts of construction.

**Henry Colon, NYCDOT, Division of Traffic Planning, e-mail to Robert Adams, NYSDOT, January 14, 2009 (via M. Strum e-mail dated January 20, 2009)**

8. Comment: Please provide additional information as to the number of workers, vehicles and trucks that will occur during Stage 2 (the overlap phase) for the 12-month period. A review of the schedule in Appendix Q was inconclusive to support the assumption that 75 workers will be on-site at each borough at one time. This was the amount provided in NYSDOT's response to comments letter but the assessment initially began with project generating 12,000 to 16,000 (depending on the alternative) jobs which was further reduced to between 7,000 on-site jobs and finally to 75 workers at each borough. Now that NYSDOT has a preferred alternative, we would appreciate the consultant preparing a table showing the hourly number of construction-related vehicles (car and trucks) on an hourly basis (showing ins and outs) from 7am to 4pm (the primary shift) for each borough. Please include all supporting information and rationale.

   The peak number of construction workers generated by the project during Stage 2 at any time would determine the number of parking spaces needed (the response to comments had stated that 55 parking spaces were needed in each borough).

   Response: As noted in Section IV.B.2.a of the FDR/FEIS/Final Section 4(f) Evaluation, each of the Build Alternatives would provide a positive economic impact to the project area through the increase in employment and purchases of building materials during construction. For the Preferred Alternative (BR-5), the project would create an estimated 6,143 temporary, on-site construction jobs and an estimated 8,001 temporary, off-site jobs. These estimates are based on a methodology used primarily for economic development measures and provide an estimate of direct and spin-off jobs based solely on construction cost and type. These numbers do not represent the total number of workers expected to be on-site at any one time. Rather, it is an estimate of the total number of jobs created during the life of the project.

   While Appendix Q of the FDR/FEIS/Final Section 4(f) Evaluation provides a preliminary construction schedule that estimates when and where major activities would likely be completed, the following discussion provides a more detailed, "small area" accounting of the maximum number of construction workers expected in an area at one time. As shown in the proposed construction schedule for Alternative BR-5, the Months 18 through 20 are expected to have, by far, the most intense activity, especially in Brooklyn. This three-month period was chosen as the peak construction period, although typical periods can be averaged over longer durations. Alternative BR-5 activities in Stage 2 (Year 2) of the project would involve some overlap of activities in both Queens and Brooklyn. As noted in our earlier response, the estimated 55 parking spaces needed in Queens are accurate. The number of parking spaces required in Brooklyn during this three-month period is greater than initially expected.

   In Brooklyn, construction activities during this three-month period are expected to occur in two primary areas centered on Varick Street and in an area near Scott and Thomas Streets. The activities around the Varick Street area include driving of steel piles (approximately 7 crew members) and construction of pile caps (approximately 47 crew members) for the foundation of the new eastbound two-lane bridge, totaling approximately 54 crew members for this major activity. In addition, work on a portion of the Brooklyn Connector near Varick Street is also expected during this three-month period, with the commencement of activities to reconstruct one-half of the Brooklyn Connector and to install a temporary bridge on the eastbound side of the existing BQE. A conservative estimate for the number of workers needed to complete these activities would be approximately 60 crew members. Additional

crew members (approximately five or fewer) will also be stationed at the layout yards. Thus, the total number of workers expected near the Varick Street area during this brief three-month period could be as high as 120 workers.

It is anticipated that approximately 35 percent of the crew members (42 workers) will arrive by mass transit. Of the anticipated 65 percent (78 workers) choosing to use automobile (passenger cars and light duty trucks), it is anticipated 71 off-street spaces will be needed (assuming 1.1 passengers per vehicle). Using a conservative factor of 400 square feet required per parking space, it is assumed approximately 28,400 square feet would be required to accommodate all crew workers. As shown in Figure III-65 of the FDR/FEIS/Final Section 4(f) Evaluation, the NYSDOT plans to acquire a number of properties adjacent to the BQE including large parcels of 39,000 square feet (Block 2811, Lot 14) and 56,000 square feet (Block 2813, Lot 1). While some of these parcels would be used for new structures and the new ramp, the NYSDOT anticipates large portions of these parcels, and parts of other parcels (Blocks 2812 and 2814) to be available prior to the commencement of any construction. Therefore, they would be available for parking for the duration of the construction period without the need for on-street parking spaces. While it is noted that daily parking is permitted and available on the local streets within this primarily industrial area, especially on the south side of the BQE, the NYSDOT seeks to minimize disruption to the community by providing adequate parking for workers.

During this same three-month period, the area near Scott and Thomas Streets would require approximately 59 crew members to construct the piers and complete the foundation of the new eastbound two-lane bridge. In addition, it is anticipated the launching of pre-cast segments for the new eastbound three-lane superstructure would be completed during this period (requiring approximately 80 crew workers). Applying the same factors, approximately 139 crew members would be arriving in approximately 82 vehicles (passenger cars and light duty trucks), requiring a parking area of approximately, 32,000 square feet. As discussed, Block 2814, Lot 10 will have more than half of its 33,000 square feet property available for parking. In addition, adjacent lots will also be available for parking. It is noted that this three-month period represents, by far, the most labor-intensive portion of the project.

Month 20 will also include construction activity in Queens, with the beginning of the launching of pre-cast segments for the new eastbound two-lane bridge (approximately 80 crew workers). (This would result in only a one month overlap with the superstructure construction in Brooklyn.) An additional five crew members are also estimated at the layout areas nearby in Queens. The 85 workers would require 50 parking spaces (arriving in passenger cars and light duty trucks) in Queens, totaling 20,000 square feet. The NYSDOT intends to acquire properties between the existing BQE and 43rd Street to accommodate the new eastbound three-lane bridge. It is anticipated that a portion of these properties would be used for parking.

As noted, this discussion estimates that the greatest number of workers (by a large amount) expected to be on-site during the life of the project would occur during this three-month peak period. Other periods of construction would require less workers and parking needs. As discussed in the FDR/FEIS/Final Section 4(f) Evaluation, work shifts are anticipated from 7:00 AM to 3:30 PM, thus avoiding the peak traffic periods on the BQE and in the area. No work is scheduled for the weekends. Based on experience, it is anticipated there would be only two daily trips per vehicle – or one in and one out per vehicle. Finally, it is anticipated workers would be drawn from areas throughout the metropolitan area and would arrive in approximately equal numbers from Brooklyn and Queens.

9. Comment: We appreciate NYSDOT agreeing to prepare the necessary signal warrant analyses to NYCDOT along with a validation of traffic volumes and LOS analysis at intersections requiring mitigation. We recommend that there be a mechanism other than the response to comments where both agencies are alerted of these action items in the project's Build year. Should the signal be warranted NYSDOT should be responsible for incurring its cost.

   Response: The NYSDOT is committed to continuing the active partnership with the NYCDOT that has been conducted over the course of this project through the Inter-Agency Advisory Committee (IAAC), which shall continue throughout the Final Design and construction phases of the project.

**Moishe Strum, NYCDOT, OCMC – Highways, e-mail to Robert Adams, NYSDOT, January 23, 2009**

10. Comment: [Drawing] PA-16: The Environmental Enhancements should discuss improvements in handling surface storm water runoff, in consultation with NYCDEP.

    Response: The NYSDOT fully intends to coordinate and consult with the NYCDEP during the Final Design phase concerning the proposed drainage system on the new bridge. As discussed in Section III.C.2.f of the FDR/FEIS/Final Section 4(f) Evaluation, stormwater runoff from the south end of the project (from approximately Sutton Street to Van Dam Street in Brooklyn) would be conveyed to an existing storm sewer system. The remainder of the stormwater runoff would be conveyed to Newtown Creek after passing through stormwater management measures such as specially designed settling tanks designed to remove suspended solids and pollutants from the stormwater runoff. New storm-sewer outfalls would be installed on each side of the creek.

11. Comment: [Drawing] ES-13: Please indicate that NYSDOT has prioritized this project.

    Response: The NYSDOT is committed to addressing the safety, operational, and structural deficiencies associated with the Kosciuszko Bridge, demonstrated by its publication of the FDR/FEIS/Final Section 4(f) Evaluation and ROD so that the NYSDOT can begin the Final Design phase of the project.

12. Comment: [Drawing] ES-26.I.4.i.: Kindly add item stating "Provisions of Articles 12 and 12-B of the New York State Highway Law."

    Response: While no subsequent document to the FDR/FEIS/Final Section 4(f) Evaluation is planned, the NYSDOT fully understands that the Provisions of Articles 12 and 12-B of the New York State Highway Law are applicable to the proposed project.

**Joshua Laird, New York City Department of Parks and Recreation (NYCDPR), letter to Norik Tatevossian, NYSDOT, January 21, 2009**

13. Comment: We are pleased to see that the preferred alternative includes a bikeway/walkway on the west side of the bridge. While we appreciate that NYSDOT will create a net increase of new parkland in conjunction with the project, we believe that NYSDOT must go through the proper alienation process for the parkland it will permanently impact at Sergeant William Dougherty Playground and the strip of parkland parallel to the Brooklyn-Queens Expressway in Queens. Given the large amount of parkland that NYSDOT will be creating in conjunction with your project as well as the significant community support for your

proposed improvements, that approval of alienation legislation for the property should not be problematic and we would be prepared to urge for its passage.

Response: The NYSDOT is committed to acquiring the NYCDPR-owned property required for the proposed project, which includes a portion of Sergeant William Dougherty Playground and the Queens park strip, through the appropriate legal mechanism.

14. Comment: As your project progresses, we expect to work closely with your agency on designs for the proposed new park spaces, particularly in Queens. These sites will present a particular design challenge given their proposed location underneath the bridge.

    Response: The NYSDOT is committed to continuing the active partnership with the NYCDPR that has been conducted over the course of this project through the IAAC, which shall continue throughout the Final Design and construction phases of the project.

15. Comment: The FEIS also notes that the areas along Newtown Creek beneath the bridge will be stabilized with rip-rap and planted with native species. Particularly since the new bridge will be built at a lower elevation than the existing bridge, NYSDOT should consult with our Natural Resources Group division on its designs for these locations to ensure their viability.

    Response: The NYSDOT is committed to continuing the active partnership with the NYCDPR that has been conducted over the course of this project through the IAAC, which shall continue throughout the Final Design and construction phases of the project.

**G. Anders Carlson, Ph.D., Director, Division of Environmental Health Investigation, New York State Department of Health (NYSDOH), letter to Norik Tatevossian, NYSDOT, January 23, 2009**

16. Comment: The Kosciuszko Bridge project will involve construction and staging activities on several New York State Department of Environmental Conservation (DEC) hazardous waste sites that involve public health oversight by the Department's Bureau of Environmental Exposure Investigation (BEEI):

    1) Greenpoint Spills #S224087

    2) Meeker Avenue #224121

    3) Phelps dodge – Laurel Hill #241002

    4) Newtown Creek #241002(A) and

    5) Any additional sites that are identified within the construction boundaries.

    It is our understanding that the FEIS authors are aware of these sites and the associated potential environmental and health concerns. However, it will also be important to consider information contained in the specific Site Management Plan (SMP) documents that are implement at specific intervals during the remedial process for each of these hazardous waste sites. As such, the future Kosciuszko Bridge Project work plan must acknowledge the need to adhere to any SMPs in place for the referenced hazardous waste sites.

Please be aware that most MSPs include a provision for DEC oversight of any ground intrusive activities.

Response: The NYSDOT is committed to reviewing all relevant information when developing the necessary mitigation measures (e.g., Health and Safety Plan, Spill Contingency Plan, soil/groundwater management plans) to identify potential hazards associated with construction activities, describe handling and disposal procedures, and establish measures to protect workers and the general public from exposure to hazardous materials. The NYSDOT is committed to coordinating with the NYSDOH throughout the Final Design and construction phases of the project.

17. Comment: As stated in the FEIS, a Community Air Monitoring Plan (CAMP) will be implemented during work involving the aforementioned hazardous waste sites. The FEIS needs to clarify/identify:

    1) The referenced CAMP that will be implemented and if it specific to demolition, construction and other activities associated with the Kosciuszko Bridge Project on the aforementioned hazardous waste sites;

    2) Plans for State agency oversight of the CAMP implementation and review of monitoring data and which agency(ies), in addition to the NYSDOH will, have that responsibility;

    3) How the perimeter will be monitored;

    4) What perimeters will be monitored;

    5) The "action levels" for response;

    6) Who will responsible for determining if these action levels are appropriate for the specific work being conducted at a specific site; and

    7) The response that will be initiated/implemented when an action level is reached.

    Response: The NYSDOT is committed to coordinating with the NYSDOH throughout the Final Design and construction phases of the project to incorporate the issues described above into the CAMP.

18. Comment: On page ES-24, the following statement is included: "(O)ne of the soil gas samples, at the intersection of Van Dam Street and Meeker Avenue, exceeded standards for total VOCs and for benzene. Total VOCs at this location exceeded the New York State Department of Health (NYSDOH) standard. BTEX (benzene, toluene, ethylbenzene and xylenes) compounds, which make up a portion of the total VOC concentration and are of greater concern, were found to be minimally above the NYSDOH standard." The NYSDOH does not have regulatory standards for soil gas concentration and the FEIS document should be revised to address this inaccuracy.

    Response: Comment noted. The following text is provided to clarify the intent of the paragraph in the FDR/FEIS/Final Section 4(f) Evaluation:

"One of the soil gas samples, at the intersection of Van Dam Street and Meeker Avenue, exceeded the NYSDOH Community Air Monitoring Plan (CAMP) response level for total VOCs. The CAMP response level for total VOCs is applied by NYSDOH and NYSDEC for evaluating airborne exposure to VOCs during remediation of contaminated sites. Since the Kosciuszko Bridge Project will not include construction of inhabitable structures, the primary route of exposure to VOCs will be during outdoor excavation activities during construction; therefore, the NYSDOH CAMP response level for VOCs is considered appropriate for evaluating potential exposure from subsurface soil gas during ground intrusive construction activities. BTEX (benzene, toluene, ethylbenzene, and xylenes) compounds, which make up a portion of the total VOC concentration and are of greater concern, were found to be minimally above the NYSDOH CAMP response level."

19. Comment: As part of the Kosciuszko Bridge Project, a public park will be demolished and new public parks constructed in Brooklyn and Queens. The potential exists for material from the destruction/construction activities of this bridge project to be used to construct the new public parks, which may create contaminant exposure pathways to the public. During construction of the new parks, care should be taken to ensure that proper testing procedures are in place for imported fill and that a clean soil cover of two-feet is provided.

    Response: The NYSDOT is committed to coordinating with the NYSDOH throughout the Final Design and construction phases of the project to incorporate the issues described above into the design of the new park spaces. Details for the testing and approval procedures for any onsite reuse of project soils will be included in a Soil Management Plan developed prior to start of construction. A Beneficial Use Determination (BUD) will be sought from NYSDEC for any project soils selected for reuse within the public park.

**Joseph E. Nelson, P.E., Consulting Engineer for Old Calvary Cemetery, letter to Norik Tatevossian, NYSDOT, January 23, 2009**

20. Comment: Pile driving activity: The FIES indicates construction will include driving piles in several locations. Pile driving activity will create vibrations in the surface and subsurface in areas surrounding this activity, potentially damaging many old and large mausoleums in 'Old' Calvary Cemetery.

    In the area of Revere Avenue, rubble stone and rock retaining walls exist at varying heights that maybe damaged, as well as, cause settlement in cemetery land.

    As and if any damages occur, NYSDOT itself must be responsible and refrain from transferring said responsibility to the contractor and the contractor's insurance.

    Response: The FDR/FEIS/Final Section 4(f) Evaluation provides a disclosure of the project's potential impacts in a "worst case scenario." The final means and methods will be determined during the Final Design phase. As such, construction methods such as pile driving may not be selected. The NYSDOT will continue its extensive public outreach effort, which includes regular consultation and discussion with property owners, residents and the community at large, during the Final Design phase to ensure Old Calvary Cemetery representatives have the opportunity to review construction plans. The NYSDOT's standard contract protocols will outline the contractor's responsibilities in case damage to private property occurs.

21. Comment: Permits and Storm Drainage: Where the FEIS mentions Permits required for this Project, NYCDEP appears to be missing. NYCDEP regulates and controls connections to storm and/or combined sewers.

    Mention was made in the FEIS that a new sewer was to be installed in Laurel Hill Boulevard and approval by NYCDEP should be obtained for same.

    As and if possible, although outside the project limits, a new sewer in Laurel Hill Boulevard should be considered in order to correct the existing poor drainage from a gutter low point in the LIE service road, Borden Ave., at the North Side of "Old Calvary" Cemetery where it fronts on the LIE. The overflow from an existing catch basin, over time, has caused the "Old Calvary" Cemetery perimeter wall, with a fence on top, to fail.

    Response: The NYSDOT fully intends to coordinate and consult with the NYCDEP on appropriate matters concerning the proposed drainage system on the new bridge, particularly in cases where permits and approvals are required.

    The project will not address drainage problems beyond the projects limits. The purpose of the proposed drainage system is to collect and discharge stormwater runoff from the new bridge, eliminating conditions on the existing bridge that allow stormwater runoff to free fall off the bridge to the ground below. As discussed in Section III.C.2.f of the FDR/FEIS/Final Section 4(f) Evaluation, stormwater runoff from the new bridge in Queens would be collected in scuppers and downspouts, and discharged to Newtown Creek via a new sewer constructed as part of this project beneath the bridge or via an existing storm sewer beneath 43rd Street.

22. Comment: Roadway Drainage: Where new fascia guard railings are to be installed, design of height must include sufficient height to protect lower adjacent property from damage from storm water splash of gutter flow over conventional fascia guard railings as well as to protect the adjacent property from snow plow discharge.

    Where scuppers are installed, piping should be at a gradient to insure against clogging by salt/sand mix in winter, as well as from ordinary grit and debris.

    Any and all scupper drain leaders should be connected directly to the street storm sewer, not discharged onto the sidewalk or gutter. This will prevent the discharge of grit and debris which causes unsafe conditions.

    Where electric boxes are installed with drain holes, these boxes collect water and each electrical box should have pipe outlet to the storm sewer system.

    Response: Details for the proposed drainage system associated with the new bridge will be developed during the Final Design phase. The NYSDOT will assiduously comply with all applicable design standards and regulations to ensure the proposed roadway drainage system prevents damage to adjacent properties beneath the bridge.

23. Comment: Project Fencing and Use of Areas Adjacent to "Old" Calvary Cemetery: Where the limits of the Project include 'Old' Calvary Cemetery frontage, please provide a 'substantial' project fence in the street area, approximately 5' away from the existing cemetery fence. Additionally, NYSDOT must undertake to include in the street area abutting the cemetery only minimal use that will not detract from feelings of relatives of those buried

there and associated activities, and not 'clutter' the area between Laurel Hill Boulevard curbing and the cemetery. NYSDOT should be responsible and determine the contractors use of this 'mapped' sidewalk area and not leave it vague in contract documents.

Response: The NYSDOT is committed to minimizing disturbance to all properties near the Kosciuszko Bridge during construction, especially sensitive land uses such as Old Cavalry Cemetery. The NYSDOT's standard contract provisions for construction projects include many "best practice" requirements that are specifically included for the purpose of avoiding, minimizing, and mitigating adverse environmental impacts. These provisions will be incorporated per NYSDOT's standard procedures.

24. Comment: Temporary Roadway at East Side of 'Old' Calvary Cemetery: Comments on the proposed temporary roadway at the east side of 'Old' Calvary Cemetery are not included herein due to the lack (of) any plans for said temporary roadway to review. Due to the close proximity of the temporary roadway to the cemetery, please send a set of temporary roadway plans to the undersigned to permit 'Old' Calvary Cemetery to comment.

    Response: Details for the proposed temporary bridge located over Laurel Hill Boulevard between 54th Avenue and 55th Avenue, required to maintain traffic on the BQE during reconstruction of the Queens ramps, will be developed during the Final Design phase. The NYSDOT will continue its extensive public outreach effort, which includes regular consultation and discussion with property owners, residents and the community at large, during the Final Design phase to ensure Old Calvary Cemetery representatives have the opportunity to review the details of this temporary bridge.

**John Filipelli, Strategic Planning and Multi-Media Programs Branch, U.S. Environmental Protection Agency (USEPA), letter to Jeffrey W. Kolb, FHWA, January 28, 2009**

25. Comment: In my June 13, 2007 letter on the draft EIS, EPA presented comments regarding air quality and the air impact analyses. The final EIS adequately addresses all the comments raised. We would like to reiterate our continued encouragement of NYSDOT's use of Environmental Performance Commitments for the utilization of materials, energy, emissions, and waste, as well as the adoption of "clean diesel" practices as air quality mitigation measures during construction, such as requiring the cleanest engines on non-road construction equipment (for example, Tier 4 engines will be available during the project's construction phase) or best available retrofit technology for older engines. Based on our review and in accordance with EPA policy, we have rated this final EIS, LO, indicating that the concerns raised on the draft have all been adequately addressed such that EPA Lacks Objection to the project.

    Response: As noted in Section D of the ROD, the NYSDOT is committed to implementing a number of air quality mitigation measures during construction, such as using diesel engine retrofitted equipment, ultra-low sulfur fuel, Diesel Oxidation Catalyst/Diesel Particulate Filters, engine upgrades, engine replacements, or combinations of these strategies.